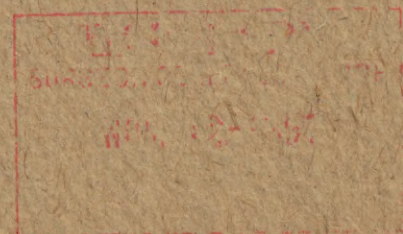


590

# Sewage Purification

PENNSYLVANIA  
SANITATION  
COMPANY

BETZ BUILDING  
PHILADELPHIA







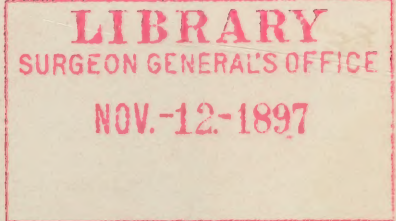


THE PENNSYLVANIA  
SANITATION COMPANY

DESIGNERS AND BUILDERS

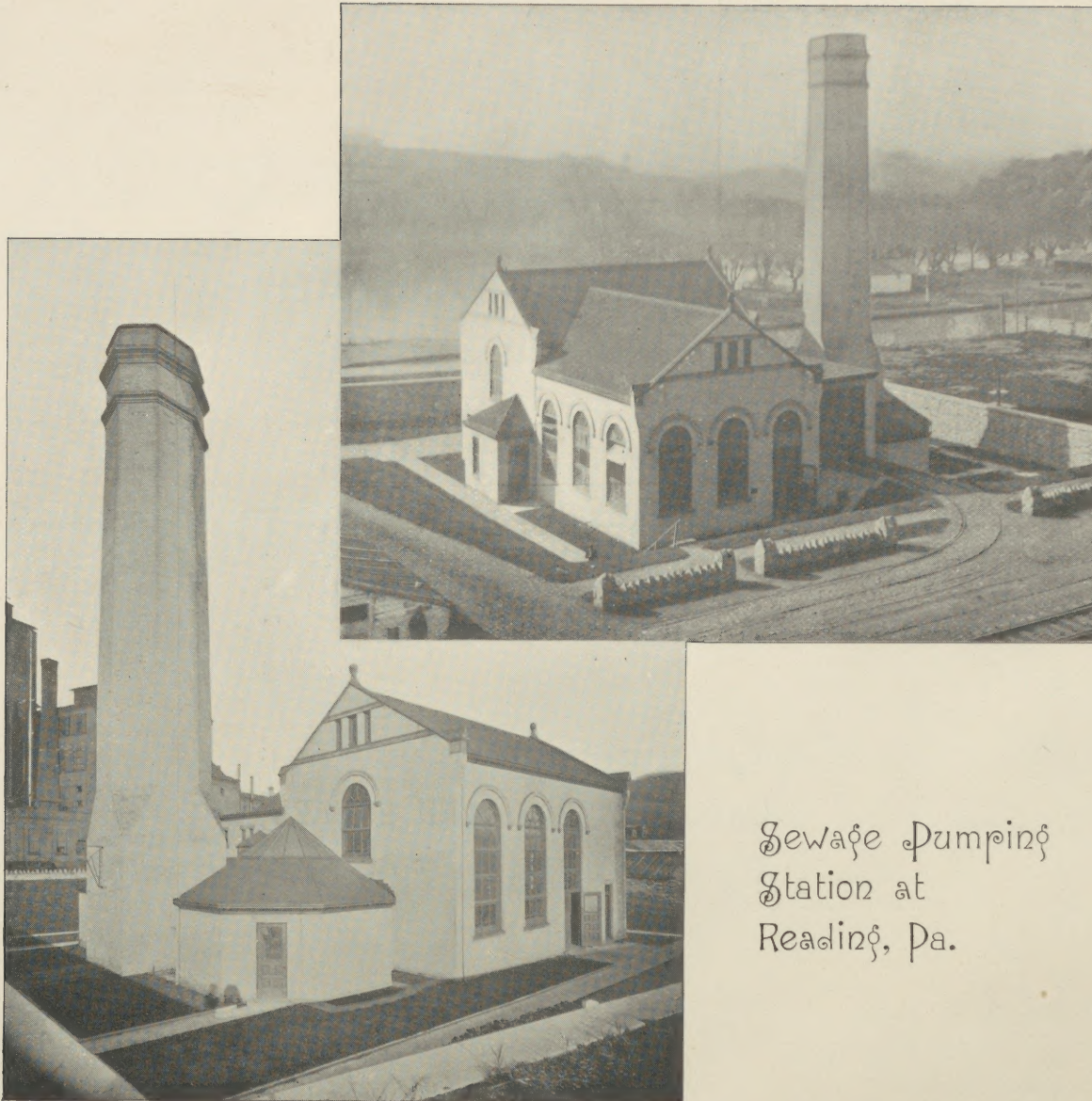
SEWAGE PURIFICATION PLANTS

BETZ BUILDING  
BROAD ST. AND S. PENN SQUARE  
PHILADELPHIA, PA.





## SEWAGE PURIFICATION.



Sewage Pumping  
Station at  
Reading, Pa.



# SEWAGE PURIFICATION.

BY

THE PENNSYLVANIA SANITATION COMPANY,

DESIGNERS AND BUILDERS,

Betz Building, Broad Street and South Penn Square, Philadelphia.

*Process patented in the United States, Canada, and Great Britain.*

## SEWERAGE SYSTEM.

It is incumbent upon all people of intelligence in this splendid age of discovery and achievement to carefully acquaint themselves with the means that are available for better condition of health, comfort and happiness. This action should be in vogue by all officials and others who are responsible for the welfare and improvement of cities, towns, villages and institutions.

The drainage question as applied to cities, towns and institutions is one of the most important problems of modern life. In towns situated upon or adjacent to fresh water streams the question is not merely how to get rid of wastes in drainage or sewerage, but to do so in a way to do no harm to other people or to neighboring municipalities, and to prevent the pollution of the rivers or streams. Most of the states of the United States have enacted laws preventing the pollution of the streams, so that it becomes an imperative necessity to adopt a house sewerage system combined with a sewage purification process.

This company, as designers and builders, are prepared to employ their patented processes in the design, construction and equipment of sewage purification plants.

The absolute elements that are essential to perfect sewage purification are combined and provided in the processes of the company, viz:—sand filtration without the aid of chemicals; constant aeration and oxygenation; exposure of sewage to air and light; beds to cultivate and keep alive the healthy, hardy scavenger micro-organisms for the destruction of the disease germs or bacilli; the oxidation of organic matter into harmless minerals; the sterilization or electrocution of disease-producing bacteria.

It is a well-established opinion of engineers that all towns and cities should be provided with two separate and independent drainage systems, one for house sewage and the other for rainfall or surface water removal. Such a basis is the most economical as well as the most efficient.

To remove all wastes and discharges from plumbing appliances in habitations buildings, workshops, factories, &c., there should be placed beneath each street, lane or alley, cement or salt glazed vitrified terra cotta pipes at depths and grades to produce self-cleansing and easy flowing, so that the sewage would flow by gravity to the receiving tank, if a pumping station was requisite, or directly to the sewage disposal plant.

The street sewers and laterals should be terra cotta pipe ranging from 10 inches to 24 inches in diameter. The connections between houses and street pipe sewers should range from 5 inches to 8 inches in diameter, with branches and bends on each connection.

The street sewers are provided throughout the extent of the system, at proper intervals and junctions, with combination man-holes and flushing tanks, each built of brick or concrete and capped with cast-iron frame, drip-pan and cover. The dead ends of pipes may be connected with rain conductors or leaders for flushing purposes.

The drainage and plumbing appliances within all buildings should be established by a code of plumbing laws to ensure proper work, good health, and prevent the unnecessary wasting of water.



## PUMPING STATION.

The pumping station is a combination of receiving reservoirs, ventilation chambers, boilers and pumping apparatus. The sewage matter is conducted thereto by gravity through the house sewerage system in the streets, and discharged into one of the two sewage receiving reservoirs over a metal distributor, the liquid falling in thin films onto a suspended screening floor, which is constructed of wrought slats, with upper and lower layers holding coarse coke to a depth of twelve inches. These screening floors intercept the grease and large floating matter, and the liquid being coarsely filtered, drops into lower section of reservoirs and flows to suction chambers. The screens are so arranged that the upper one is readily removed at stated intervals and the coke transferred by overhanging crane and tilting bucket to brick steam-heated ovens, designed to extract the grease from it. A constant and copious supply of fresh air is introduced into reservoirs above and below the screening floors. It is kept in rapid circulation by special ventilating passages surrounding the smoke flue of the chimney stack, and is discharged into the atmosphere at a height of at least one hundred feet.

The receiving reservoirs are lined above the screening floors with white enameled brick or tiles, and below with vitrified brick, thereby preventing absorption. They are well lighted by overhead skylights for illumination, and for light as an aid to purification. Appliances are arranged to facilitate inspection and provide a ready means of maintaining the reservoirs in their proper condition. By a series of gate valves, they may be used jointly or separately.

From the reservoirs the sewage is drawn into an elongated suction chamber, and from thence is lifted by action of the pumps. Each of these pumps is to be of sufficient capacity to lift and discharge as many million gallons of crude sewage in twenty-four hours as required, and each set of pumps is provided with a surface condensing pump. Working facility and the economy of space will be kept in mind in the designing of the internal arrangement of the building. Within these limits are located the office, lavatory, work room, oil and waste room, engine room, boiler

room, coal, coke and ash storage rooms, and the receiving reservoirs.

The boiler room will be of ample dimensions to accommodate batteries of boilers with their accompanying hot water well and feed pumps.

The building should be fire-proof in every particular, the exterior presenting a pleasing architectural effect. It might be faced with light colored bricks and trimmed with moulded bricks and terra cotta in the same color. The cornices of copper or terra cotta and the roofs covered with tiles or heavy galvanized corrugated iron. The interior to be finished in red brick, laid in same colored mortar. All floors to be composed of concrete base and granolithic cement surface. Proper provision to be made for draining all parts of the building. The earth displaced by excavation may be formed into an embankment around the building and space provided for a drive-way with sidewalks.

If the gradients in sewers and the topography will permit, the pumping station may be omitted and sewage be conducted by gravity to the sewage disposal plant.

As a result of the thorough manner of the construction of the pumping there can be absolutely no odor within the building, not even in the receiving reservoirs. The method by which this very desirable result is obtained is protected by letters patent of the United States and cannot be produced by others without infringement.

## PURIFICATION STATION.

The design for a sewage disposal plant contemplates the erection of filter beds to be located on the river bank or other suitable site at any distance below the pumping station. From the latter to these filter beds the sewage is constantly and rapidly removed, thereby preventing fermentation. The filter beds are divided into upper and lower sections, or may be on one level, as site or conditions determine, in order to combine bacterial filtration and oxygenation.

The crude sewage is brought on to filter beds from the pumping main through lateral pipes controlled by valves.



These pipes have open gutter distributors whose surface is about one foot above the water level of the filters below them. The beneficent action of light and air is here secured. The water passing in thin films from these distributors in its descent falls upon slatted floors, which break up the body of water into spray and small globules, getting by this means thoroughly aerated and prepared for the purification which is to follow.

The upper filter is divided into compartments for cleaning and renewal purposes. It is elevated above the ground and exposed on all sides to the open air. The support of the filter media consists of iron pipes resting upon beams and girders, and they in turn, upon columns, thus transferring the weight to the ground. On this pipe floor is laid broken stone in three layers and of different sizes, the largest being next to the pipe with the smaller sizes above it. Upon it is placed fine bar sand to a depth of two or three feet, on which rests the slatted floor.

The slatted floor serves the purpose of keeping the sand from being blown away when a bed is not in operation, and also allowing it to float up with the water so as to be upon the surface and prevent the wind from forming waves, which would be detrimental in any large system of water or sewage purification. As the slatted floors are in sections, they are usually removed after the water has been cut off, and the surface of the filter beds, being exposed to the action of the air and light, soon becomes thoroughly dry, when the sediment and gelatinous deposit upon them, together with  $\frac{1}{4}$  to  $\frac{1}{2}$  inch of sand is removed and may be used as a fertilizer. Fresh sand is employed to replace the small quantity that has been removed. The body of the sand does not require cleaning or renewal at any time.

Usually there is a head of water over the top of the filter about one foot deep, and this, without the aid of any other pressure than its own weight, passes through the filtering media. On the surface of the bed is formed a gelatinous product which arrests all matter in suspension. These open-air elevated filter beds compel the oxygen of the atmosphere to be constant in its pressure both above and below them, which enables the hardy scavenger organisms to keep in a healthy state of action and enables them

to reduce all animal and vegetable matter into harmless minerals, thereby removing all disease-producing germs.

The water leaving the filter passes in drops like rain through the open air a distance of ten feet, and strikes upon the lower bed. The top coating of this bed being a strata of broken stone, causes the water to splash similar to rain upon a roof or pavement, and rebound. The water in its descent is thoroughly aerated, and should there be organic matter present it would be burned by its contact with the oxygen of the air, and, further, sterilized by electrification, due to the concussion among the drops themselves and against the wet rock, while all gases are liberated and set free in the atmosphere. The water, by gravity, passes through the lower filter bed, which is supplied with air by pipes having proper inlets and outlets for the circulation of it, and the gutters are a conduit for both water and air. The floor is of concrete, on which rests layers of broken stone of different sizes, and upon this sub-strata is placed coarse sand. The water in its passage through these beds undergoes the same method of purification as it does in the upper beds. The effluent discharged from them is substantially chemically and bacteriologically pure.

Crude sewage may be applied to this plant at the rate of 12,000,000 gallons per acre daily, undergoing a transformation that makes the effluent water more pure and wholesome than is to-day supplied as drinking water to the cities and towns of the United States. This fact is demonstrated by the operation of the sewage purification plant which the company designed and constructed for the City of Reading, Pa., (population nearly 100,000.)

There is removed over 99 per cent. of all bacteria and over 90 per cent. of all organic matter, as proven by the report of the bacterial and chemical tests made by Drs. W. M. L. Coplin and H. F. Harris, Professors of Pathology and Bacteriology at the Jefferson Medical College, of Philadelphia. (Dr. Coplin is the bacteriologist to the State Board of Health of Pennsylvania.)

By the process of the company all malignant disease-producing organisms perish within the filters, and all vegetable matter in suspension is held on top of them. The beds

are elevated and surrounded by air to propagate, feed, and keep alive in healthy condition the innumerable hardy scavenger active micro-organisms which are at work within. These micro-organisms cause the removal of all animal and vegetable matters and convert them into harmless mineral products. The oxygen of the air being in constant circulation through the filters keeps in a vigorous healthy condition the hardy bacteria, enabling them to properly perform their functions of purification. Sand does not purify; it is only an auxiliary, simply holding the bacteria. The oxygen, in addition, is an assistant in its action as a nitrifying or burning process of organic matter.

Over 99 per cent. of disease-producing bacilli and microbes are removed from the water, as well as all sediment and vegetable matter, while the water is passing through the filter beds, producing a complete chemical and bacteriological purification. The effluent water is pure, clear, sparkling, colorless and odorless, and as potable as any drinking water furnished for domestic purposes.

## BUSINESS PROPOSITIONS.

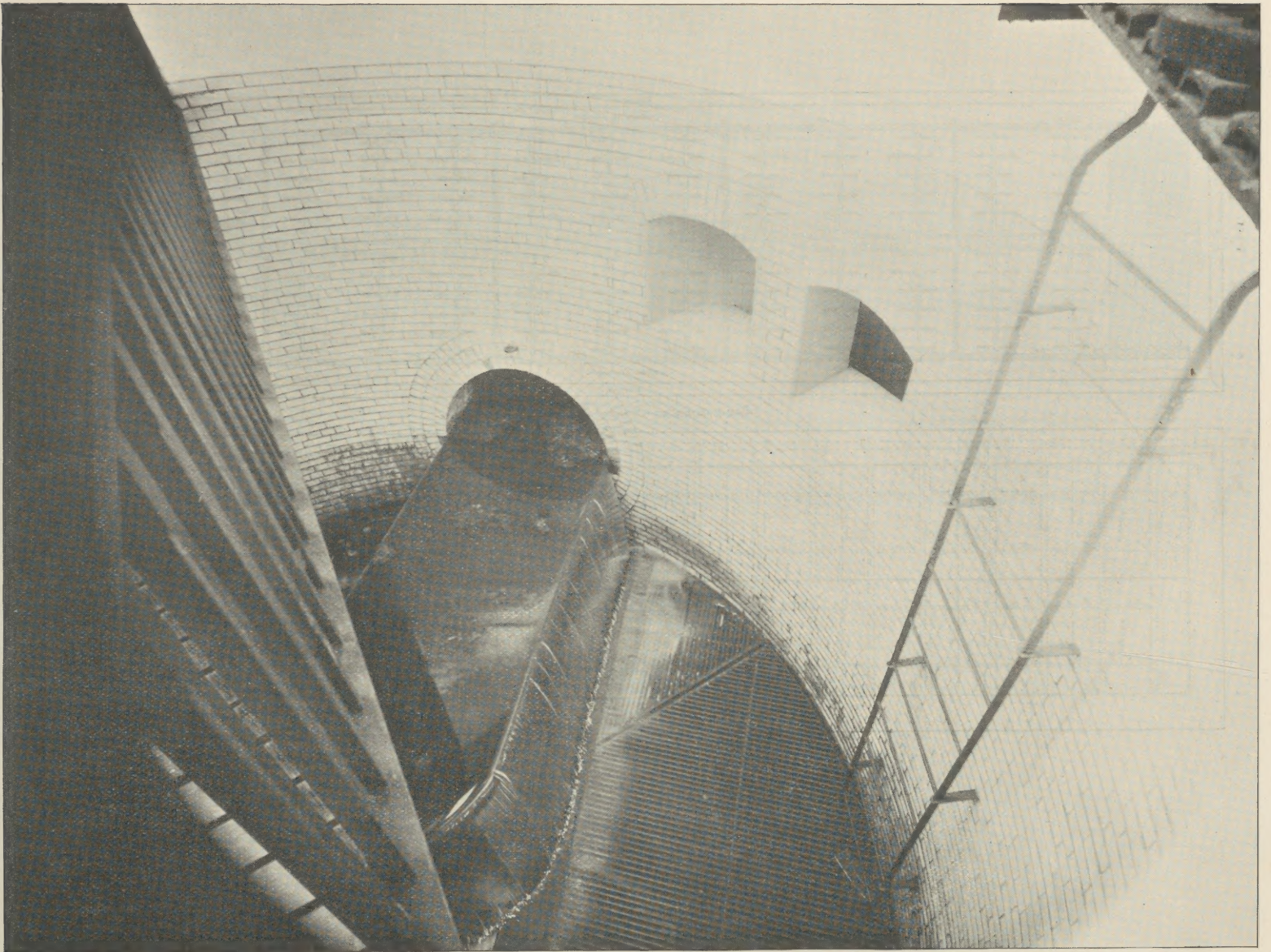
The company is prepared to contract with any city, town, corporation, college, institution, manufactory, etc., as follows:—

1st. To design, construct and equip the sewage purification system for a stipulated price, transferring all patent rights to the city or corporation.

2nd. To design, construct and equip the sewage purification system, maintaining and operating it at its own expense. The company to be paid an annual rental by the city or corporation, or to be given a franchise where citizens pay for its use by a code of rates based on each plumbing fixture in use in the buildings.

3rd. To design the sewage purification system for city or corporation, providing full sets of general drawings, specifications, detail drawings, supervision and the transfer of patent rights. The city or corporation to place the work under construction in a manner it may deem proper and best.

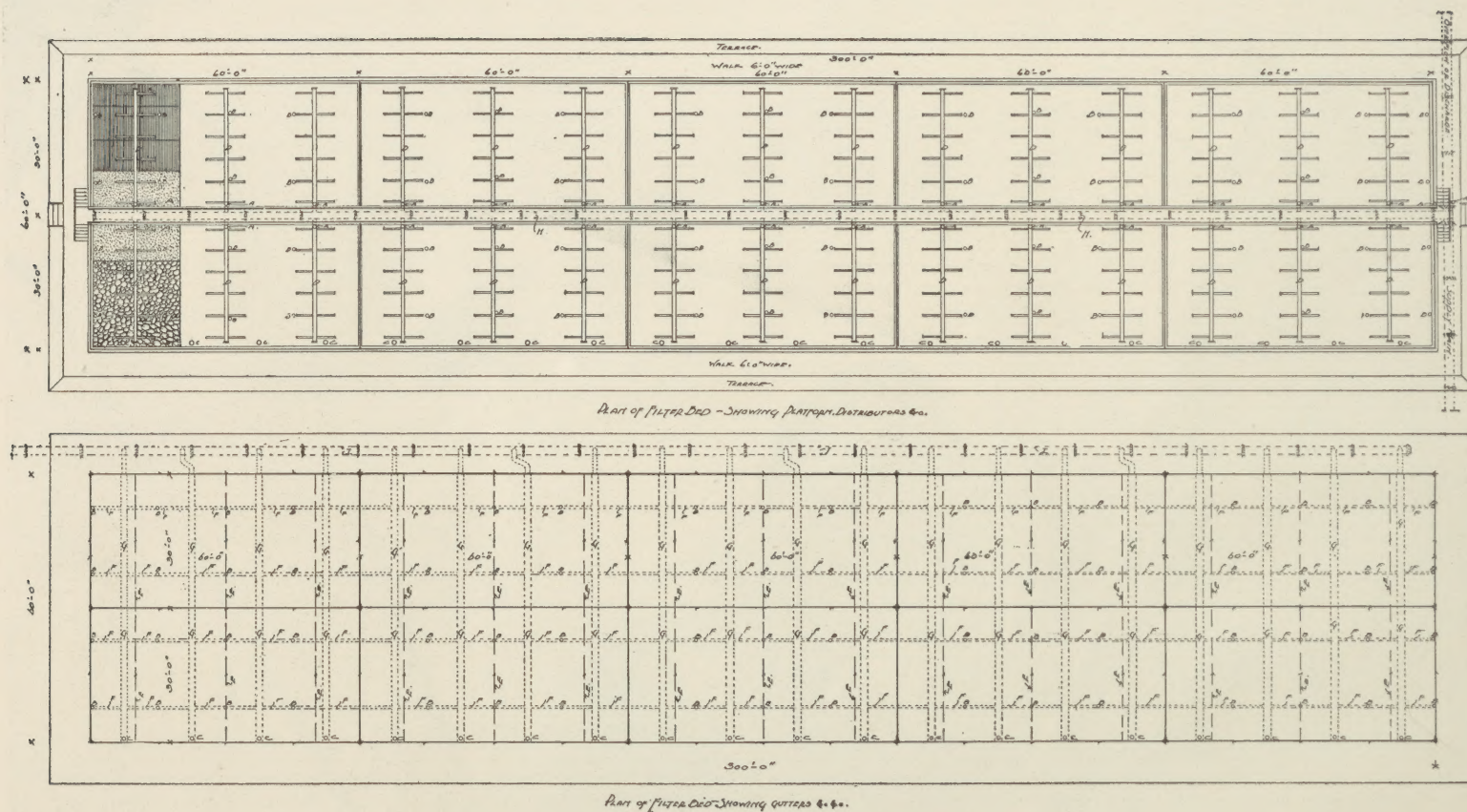




INTERIOR OF A SEWAGE RECEIVING RESERVOIR, SHOWING DISTRIBUTOR, SCREENING FLOOR, AIR VENTS, ETC.



## SEWAGE PURIFICATION.



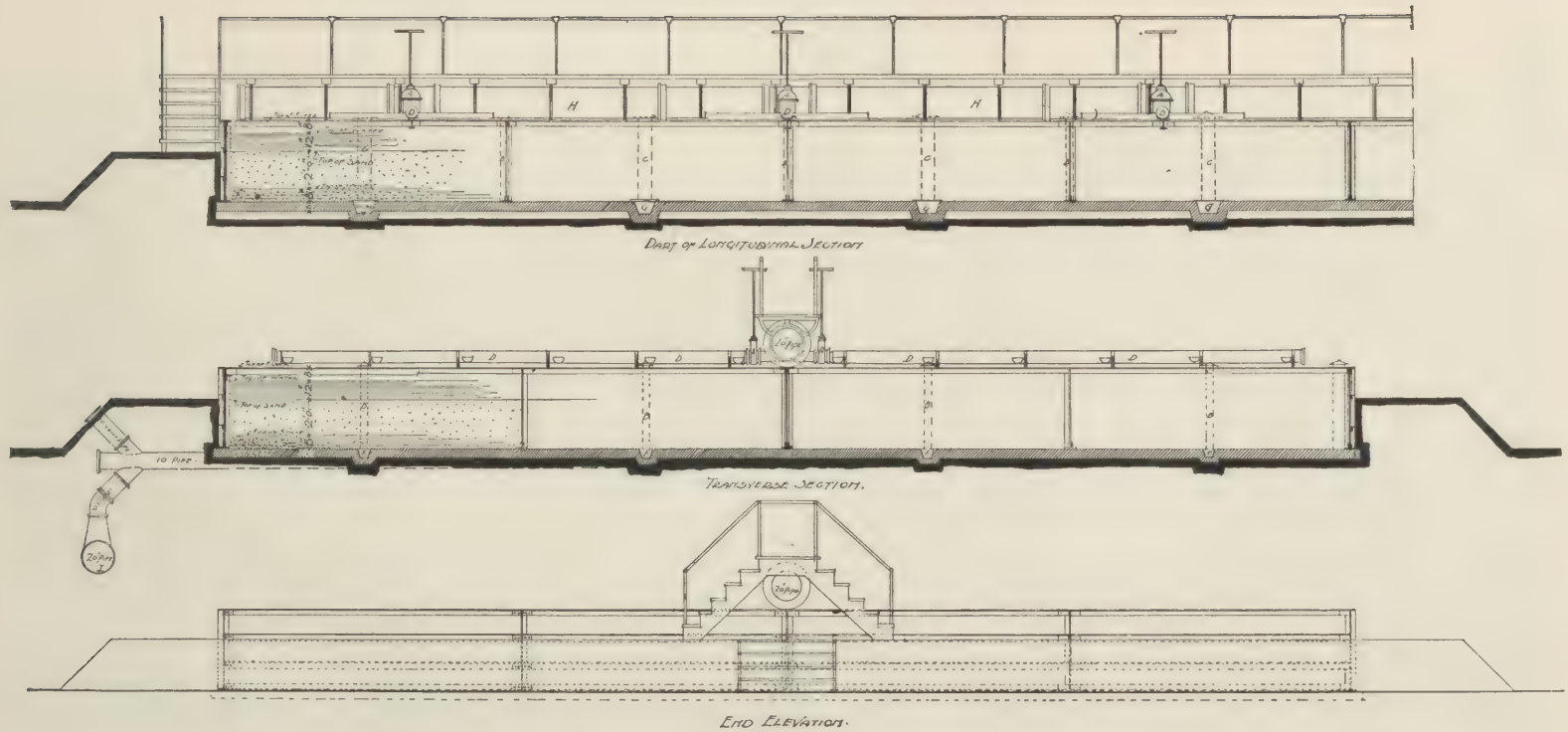
PLANS OF FILTER BEDS LOCATED ON GRADE.

## KEY.

- |                              |                   |
|------------------------------|-------------------|
| A.—Cut-off Valves.           | F.—6" Gutters.    |
| B.—4" Vent Pipes.            | G.—15" Gutters.   |
| C.—8" Vent Pipes.            | H.—Supply Main.   |
| D.—Distributors.             | I.—Effluent Main. |
| E.—1 Beams for Distributors. |                   |

This Key is for pages 8 and 9.





ELEVATION AND SECTIONS OF FILTER BEDS LOCATED ON GRADE.





FORMATION OF THE UPPER SECTION OF THE FILTER BEDS, SHOWING FILTER SUPPORTS, FILTERING MATERIALS, SUPPLY MAIN, ETC.





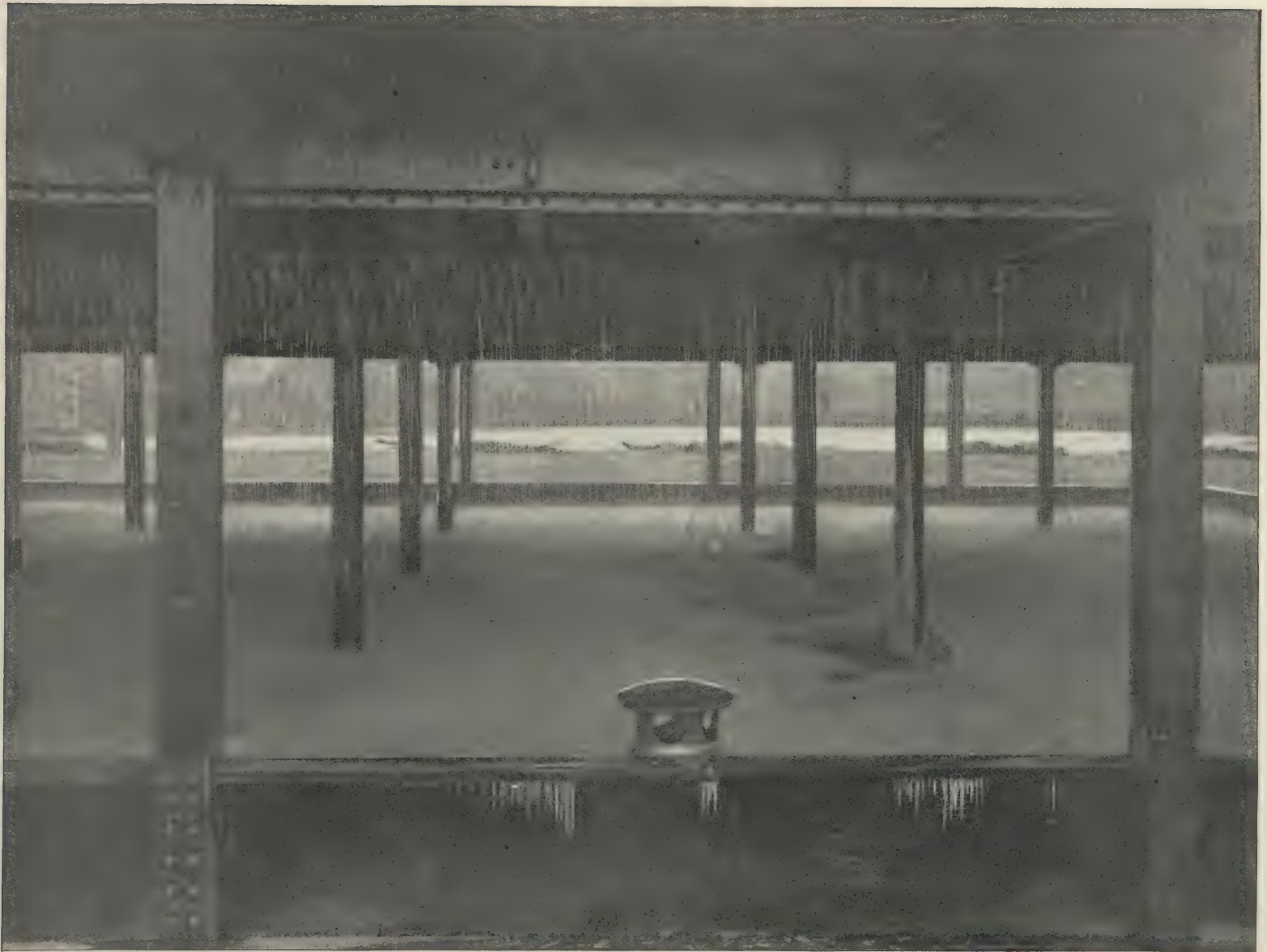
SURFACE OF THE UPPER SECTION OF THE FILTER BEDS, SHOWING DISTRIBUTORS, VALVES, PLATFORMS, SLATTED SCREENS, ETC.





FORMATION OF THE LOWER SECTION OF THE FILTER BEDS, SHOWING FILTERING MATERIALS, SUPPORTS OF UPPER SECTION, ETC.





LOWER SECTION OF THE FILTER BEDS, SHOWING WATER DROPPING FROM UPPER BEDS TO SURFACE OF LOWER BEDS FOR OXYGENATION ; OUTLET OF AIR CIRCULATING PIPES OF LOWER BEDS, ETC.





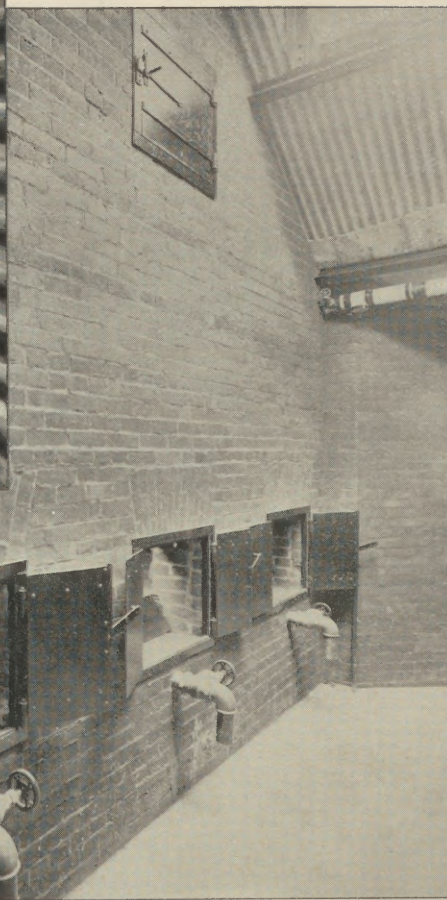
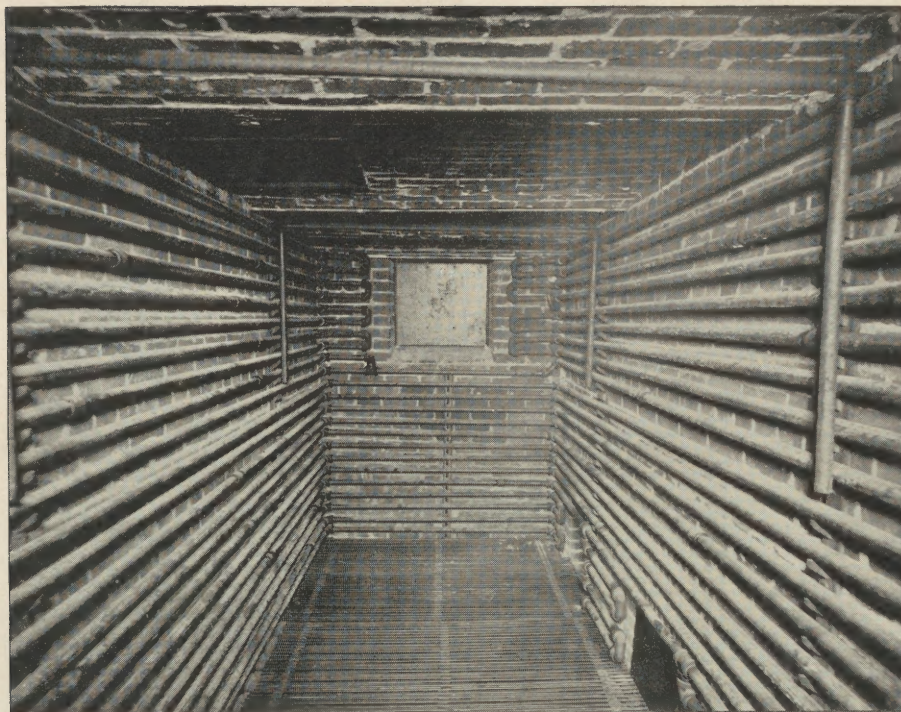
FILTER BEDS IN SERVICE FOR CITY OF READING, PA. TEN COMPARTMENTS; TOTAL CAPACITY, 5 000,000 GALLONS PER DAY.





FILTER BEDS IN SERVICE FOR CITY OF READING, PA. TEN COMPARTMENTS; TOTAL CAPACITY, 5,000,000 GALLONS PER DAY.





Interior and Exterior  
of Grease and  
Coke-Rendering Ovens.







